

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Darby, et al

Serial No.: Unassigned

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For: A COMMUNICATIONS SYSTEM AND METHOD FOR
INTERCONNECTED NETWORKS HAVING A LINEAR TOPOLOGY,
ESPECIALLY RAILWAYS

PRELIMINARY AMENDMENT

The Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

Preliminary to examination of the subject application, please amend the subject application as follows:

Please cancel Claims 1-21 without prejudice.

Please add the following new Claims 22-57:

-22. (New) A method of determining the physical order of plural railcars in a train consist where the railcars are connected to each other through a pneumatic brake pipe and an RF communication link and where the train consist includes at least one head end unit (HEU), comprising the steps of:

a. transmitting a pneumatic pressure pulse along the brake pipe from a selected HEU to the other railcars;

- b. transmitting an RF signal from the selected HEU to the railcars;
- c. receiving the RF signal at a first railcar;
- d. receiving the pneumatic pressure pulse at the first railcar;
- e. transmitting an RF message from the first railcar to the HEU indicating the position of the first railcar;
- f. receiving the RF signal from the first railcar at a second railcar;
- g. receiving the pneumatic pressure pulse at the second railcar;
- h. transmitting an RF message from the second railcar to the to the HEU indicating the position of the second railcar; and
- k. for each remaining railcars successively:
 - (1) receiving at least one an RF signal from another railcar announcing the transmitting railcar's relative position;
 - (2) receiving the pneumatic pressure pulse;
 - (3) determining the position of the railcar as a function of the time between the receipt of the pneumatic pulse and the receipt of the immediately preceding RF message from another railcar.
 - (4) transmitting the determined relative order of the railcar to the HEU.

--23. (New) The method of Claim 22 further comprising the step of modifying the received pneumatic pulse at each railcar prior to retransmission of the pneumatic pulse to thereby facilitate the determination of the time of receipt of the pulse at other railcars.

--24. (New) The method of Claim 22 further comprising the step of maintaining a log at each railcar, wherein the log includes the time between the receipt of the pneumatic pulse and the receipt of the immediately preceding RF signal from another railcar.

--25. (New) The method of Claim 24 further comprising steps of transmitting the log from each railcar to the HEU and evaluating the received logs at the HEU to thereby detect errors in the determined position of the railcars.

-26. (New) The method of Claim 23 where the pneumatic pressure pulse is a positive pulse with respect to the normal pressure of the brake pipe.

--27. (New) The method of Claim 23 where the pneumatic pressure pulse is a negative pulse with respect to the normal pressure of the brake pipe.

-- 28. (New) In a train comprising at least one head end unit (HEU) and plural railcars connected by a pneumatic brake pipe and an electrical communications link, a method of determining the relative order of the railcars in the train comprising the steps of:

- a. transmitting a pneumatic pressure pulse along the brake pipe from the HEU to the plural railcars;
- b. transmitting an electrical signal from the HEU announcing the transmission of the pressure pulse;
- c. transmitting an electrical signal at each car upon receipt of the pressure pulse;
- d. determining the relative order at each railcar as a function of the difference between the time of receipt of the pneumatic pressure pulse and the time of receipt of the immediately preceding electrical signal.

-- 29. (New) In a train comprising at least one head end unit (HEU) and plural railcars, where the HEU and railcars are coupled together through a pneumatic brake pipe and each railcar and HEU contains a communication unit for sending and receiving electrical signals, a method of determining the relative position of each railcar in the train comprising the steps of:

(a) transmitting a pneumatic pulse from the HEU to each railcar through the brake pipe;

(b) transmitting an electrical signal from each railcar to the other railcars and HEU upon receipt of the pneumatic pulse; and

(c) determining the relative position of each railcar in the train as a function of the receipt of the pneumatic pulse and the electrical signal from another railcar.

-- 30. (New) The method of Claim 29 wherein the electrical signal from the step of determining is the immediately preceding electrical signal received from another railcar.

-- 31. (New) The method of Claim 29 wherein the step of transmitting an electrical signal from each railcar includes announcing the relative position of the transmitting railcar in the train.

-- 32. (New) In a train comprising at least one head end unit (HEU) and plural railcars where the HEU and railcars are coupled together through a pneumatic brake pipe and each railcar and HEU contains a communication unit for sending and receiving messages, a method of each railcar determining its relative position of each railcar in the train, comprising the steps of:

(a) transmitting a pneumatic pulse from the HEU to each railcar through the brake pipe;

(b) transmitting an electrical signal from the HEU to the railcars;

(c) receiving the pneumatic pulse at a railcar;

(d) transmitting an electrical signal from each railcar upon receipt of the pneumatic pulse;

(e) determining the relative position of each railcar in the train as a function of the time of receipt of the pneumatic pulse and the receipt of an electrical signal from another railcar.

-- 33. (New) The method of Claim 32 wherein the electrical signal from the step of determining is the immediately preceding electrical signal received from another railcar.

-- 34. (New) The method of Claim 32 wherein the relative order is determined by measuring at each railcar the time between the receipt of the pneumatic pulse and the receipt of the of the latest received electrical signal from another railcar.

-- 35. (New) The method of Claim 34 further comprising the step of transmitting the measured information from each railcar to the HEU.

-- 36. (New) The method of Claim 35 further comprising the step of evaluating the measured data received from the railcars to identify errors in the determined position of the railcars in the train.

-- 37. (New) The method of Claim 32 wherein the step of transmitting an electrical signal from each railcar includes the step of monitoring for the transmission of other railcars

prior to transmitting to thereby avoid having multiple railcars claim the same relative position in the train.

-- 38. (New) In a train comprising at least one head end unit (HEU) and plural railcars where the HEU and railcars are coupled together through a pneumatic brake pipe and each railcar and HEU contains a communication unit for sending and receiving electrical signals, a method of determining the relative position of each railcar in the train comprising the steps of:

(a) transmitting an electrical signal and a pneumatic pulse from the HEU to each railcar;

(b) transmitting an electrical signal from each railcar upon receipt of the pneumatic brake pulse;

(c) determining the relative position of each car in the train as a function of the difference in time between the receipt of the pressure pulse and the receipt of the last received electrical signal.

-- 39. (New) The method of Claim 38 wherein the step of transmitting an electrical signal from each railcar comprises transmitting the determined position of the railcar in the train.

-- 40. (New) The method of Claim 38 further comprising the step of:

(d) modifying the received pneumatic pulse at each railcar prior to retransmission of the pneumatic pulse to thereby facilitate the determination of the time of receipt of the pulse at other railcars.

-- 41. (New) In a method of determining the relative position of plural railcars in a train having at least one head end unit ("HEU") where the HEU and all of the railcars are connected by pneumatic and wireless communication systems, the improvement wherein each railcar determines its relative position in the train from receipt of a pneumatic signal originating from the HEU and a wireless signal from one of the railcars.

-- 42. (New) The method of Claim 41 wherein the railcar originating the wireless signal changes as a function of the receipt of the pneumatic signal at the railcars in the train.

-- 43. (New) In a method of determining the relative position of plural railcars in a train having at least one head end unit ("HEU") where the HEU and all of the cars are connected by a common pneumatic communication system and where the HEU and each of the railcars is connected to a plurality of the railcars by a wireless communication system, the improvement wherein each railcar determines its relative position in the train using the signal received over the wireless communication system in closest proximity to receipt of a pneumatic signal.

-- 44. (New) In a train comprising at least one head end unit (HEU) and a plurality of railcars connected by a pneumatic brake pipe and an electrical communications link with each railcar in the train and the HEU, a method of determining the order of the railcars comprising:

- a. transmitting a pneumatic pressure pulse along the brake pipe so as to travel in sequence to each railcar of said plurality of railcars;

- b. receiving the pneumatic pressure pulse at the railcars in the train;
- c. transmitting an electrical signal from each of the plurality of railcars indicative of the time at which the pneumatic pressure pulse was received at the respective rail car; and
- d. determining the order of the railcars in the train based on the electrical signals.

--45. (New) The method of Claim 44 further comprising establishing and recording the order of the railcars at the HEU.

--46. (New) The method of Claim 44 wherein the electrical signal comprises a unique address assigned to each railcar based on the time at which the pneumatic pressure pulse reached the transmitting rail car.

--47. (New) The method of Claim 46 wherein the unique address is a numerical identifier indicating the position of the other railcars in the train.

-- 48. (New) The method of Claim 47 wherein each one of the plurality of railcars self-determines the unique address based on the position of the railcar in the train.

-- 49. (New) The method of Claim 48 wherein each railcar transmits an address-containing electrical signal after self-determining a unique address, and wherein subsequent railcars self-determine an address based on the address-containing electrical signal received from previous railcars in the train.

-- 50. (New) The method of Claim 44 wherein upon receiving the pneumatic pressure pulse, the receiving railcar vents the segment of the brake pipe on the receiving railcar.

-- 51. (New) In a train comprising at least one head end unit (HEU) and a plurality of railcars connected by a pneumatic brake pipe and an electrical communications link with each railcar in the train and the HEU, a method of determining the order of the railcars comprising:

a. transmitting a first electrical signal from the HEU to the plurality of railcars announcing the transmission of a pressure pulse along the brake pipe ;

b. transmitting a pneumatic pressure pulse on the brake pipe to the plurality of railcars, wherein the pneumatic pressure pulse is received at each of the plurality of railcars after receipt of the first electrical signal;

c. transmitting a second electrical signal from each of the plurality of railcars indicative of the time at which the pneumatic pressure pulse was received at the respective rail car the transmitting rail car.

--52. (New) The method of Claim 51 further comprising determining the order of the railcars in the train based on the second electrical signals.

-- 53. (New) The method of Claim 52 further comprising establishing and recording the order of the railcars at the HEU.

-- 54. (New) The method of Claim 51 wherein the second electrical signal is indicative of a unique address assigned to each railcar based on the time at which the pneumatic pressure pulse reached the transmitting rail car.

-- 55. (New) The method of Claim 51 wherein the second electrical signal comprises a unique address indicating the position of the railcar in the train, and wherein the second electrical signal is received by at least one other of the plurality of railcars for use in determining the position of the receiving railcar in the train.

-- 56. (New) The method of Claim 54 wherein the unique address is transmitted from each one of the plurality of railcars to the HEU in response to a polling signal transmitted from the HEU.

-- 57. (New) In a train comprising at least one head end unit (HEU) and plural railcars connected by a pneumatic brake pipe and an electrical communications link, a method of determining the relative order of the railcars in the train comprising the steps of:

a. transmitting a first electrical signal announcing a transmission of a pressure pulse along the brake pipe to the railcars;


b. transmitting a pneumatic pressure pulse along the brake pipe to the plurality of railcars, with each railcar receiving the pneumatic pulse at a different time from that of the other railcars in the train, with said time being later than that of the preceding railcars and earlier than that of successive railcars;

c. transmitting a sequence of second electrical signals from the railcars, with

one of said second electrical signals being transmitted for each railcar upon receipt of the pressure pulse at that respective railcar; and

d. determining the relative order at each railcar in the train as a function of the timing of said second electrical signals.

Respectfully submitted,

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